Claims

[c1] A data transceiver comprising:

input means for supplying a differential input data signal;

a transmitter;

a receiver;

a data link between said transmitter and said receiver; and

output means for receiving a differential output data signal;

said transmitter for:

(a) receiving the differential input data signal from said input means,

(b) receiving a feedback signal from said receiver to equalize the data eye of the differential input data signal, and

(c) equalizing, in response to the feedback signal, the data eye of the differential input data signal;

said receiver for:

(a) receiving the differential input data signal from said transmitter,

(b) determining the extent of the data eye of the differential input data signal,

(c) developing the feedback signal in response to the determination of the extent of the data eye of the differential input data signal; and

(d) supplying the differential output signal to said output

means, and

said data link for conducting:

(a) the differential input data signal from said transmitter to said receiver, and

(b) the feedback signal from said receiver to said transmitter, and

including:

(a) a first line for conducting the data positive signal of the differential input data signal, and

(b) a second line for conducting the data negative signal of the differential input data signal.

[c2] A data transceiver according to claim 1 wherein:

(a) said input means include a serializer for developing from an input in parallel format the differential input data signal and supplying the differential input data signal to said transmitter in serial format,

(b) said output means include a deserializer for receiving from said receiver the serialized differential input data signal and developing from the serialized differential input data signal an output in serial format, and

(c) said data link conducts the serialized differential input data signal from said transmitter to said receiver.

[c3] A data transceiver according to claim 2 wherein:

(a) said receiver further includes means responsive to the

serialized differential input data signal for:

(1) measuring the Bit Error Rate of the serialized differential input data signal,

(2) calculating, from the measurement of the Bit Error Rate, the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal,

(3) developing, from the calculation of the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal, the feedback signal, and

(4) conducting the feedback signal to said data link, and

(b) said transmitter further includes:

(1) means for generating a reference signal related to the common mode of the serialized differential input data signal,

(2) means for comparing the reference signal with the feedback signal to develop a difference signal representative of the difference between the reference signal and the feedback signal,

(3) a driver circuit having a variable, frequency-selective gain to which the serialized differential input data signal is conducted, and

(4) means responsive to the difference signal for controlling the amplification of said driver circuit to alter

the data eye of the serialized differential input data signal.

[c4] A data transceiver according to claim 2 wherein:

(a) said receiver further includes means responsive to the serialized differential input data signal for:

(1) measuring the Bit Error Rate of the serialized differential input data signal,

(2) calculating the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal,

(3) developing, from the calculation of the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal, the feedback signal, and

(4) conducting the feedback signal to said data link, and

(b) said transmitter further includes:

(1) means responsive to a common mode signal representative of the common mode of the serialized differential input data signal for generating:

(i) a first reference signal representative of the level of the average common mode of the serialized differential input data signal,

(ii) a second reference signal representative of a level a prescribed amount above the average common mode of the serialized differential input

data signal, and

(iii) a third reference signal, equal and opposite to the second reference signal, representative of a level a prescribed amount below the average common mode of the serialized differential input data signal,

(2) means for comparing the reference signals with the feedback signal to develop:

(i) a first difference signal representative of the difference between the first reference signal and the feedback signal,

(ii) a second difference signal representative of the difference between the second reference signal and the feedback signal, and

(iii) a third difference signal representative of the difference between the third reference signal and the feedback signal,

(3) means for selectively coupling:

(i) the first reference signal to said comparing means, and

(ii) the second reference signal and the third reference signal alternately to said comparing means,

(4) a driver circuit having a variable, frequency-selective gain to which the serialized differential input data signal is

conducted, and

(5) means responsive to the difference signals for controlling the amplification of said driver circuit to alter the data eye of the serialized differential input data signal.

[c5] A data transceiver according to claim 4 wherein the Bit Error Rate of the serialized differential input data signal is measured at selected sampling points across the data eye of the serialized differential data signal in time.

[c6] A data transceiver according to claim 5 wherein the amplitude of the data eye of the serialized differential input data signal is measured with the Bit Error Rate of the serialized differential input data signal to calculate the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal.

[c7] A method of equalizing the data eye of a differential input data signal conducted from a first location to a second location through a data link, said method comprising the steps of:
supplying a differential input data signal to a first location;
conducting the differential input data signal from the first location to a second location through a data link;
determining, at the second location, the extent of the data eye of the differential input data signal;
developing, at the second location and from the determination of the extent of the data eye of the differential input data

signal, an indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal;

conducting, from the second location to the first location, the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal;

equalizing, at the first location and in response to the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal, the data eye of the differential input data signal; and

supplying the differential input data signal from the second location.

[c8] A method of equalizing the data eye of a differential input data signal according to claim 7 further comprising the steps of:

(a) serializing an input in parallel format to produce the differential input data signal supplied to the first location, and

(b) deserializing the serialized differential input data signal supplied from the second location to produce an output in parallel format.

[c9] A method of equalizing the data eye of a differential input data signal according to claim 8 wherein:

(a) the step of determining the extent of the data eye of the differential input data signal includes measuring the

Bit Error Rate of the serialized differential input data signal,

(b) the step of developing an indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal includes calculating, from the measurement of the Bit Error Rate, the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal, and

(c) the step of equalizing the data eye of the differential input data signal includes:

(1) generating a reference related to the common mode of the serialized differential input data signal,

(2) comparing the reference with the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal, and

(3) altering the data eye of the serialized differential input data signal according to the difference between the reference and the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal.

[c10] A method of equalizing the data eye of a differential input data signal according to claim 8 wherein:

(a) the step of determining the extent of the data eye of

the differential input data signal includes measuring the Bit Error Rate of the serialized differential input data signal,

(b) the step of developing an indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal includes calculating, from the measurement of the Bit Error Rate, the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal,

(c) the step of equalizing the data eye of the differential input data signal includes:

(1) generating:

(i) a first reference representative of the level of the average common mode of the serialized differential input data signal,

(ii) a second reference representative of a level a prescribed amount above the average common mode of the serialized differential input data signal, and

(iii) a third reference, equal and opposite to the second reference, representative of a level a prescribed amount below the average common mode of the serialized differential input data signal,

(2) selectively comparing the references with the

indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal, and

(3) altering the data eye of the serialized differential input data signal according to:

(i) the difference between the first reference and the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal,

(ii) the difference between the second reference and the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal,

(iii) the difference between the third reference and the indication of the degree of the equalization needed to produce a desired data eye for the differential input data signal.

[c11] A method of equalizing the data eye of a differential input data signal according to claim 10 wherein the Bit Error Rate of the serialized differential input data signal is measured at selected sampling points across the data eye of the serialized differential data signal in time.

[c12] A method of equalizing the data eye of a differential input data signal according to claim 11 wherein the amplitude of the data

eye of the serialized differential input data signal is measured with the Bit Error Rate of the serialized differential input data signal to calculate the degree of the equalization needed to produce a desired data eye for the serialized differential input data signal.